



FY 1999 Technology Deployment in Environmental Management

Engineering Tomorrow's Solutions Today

**Site Technology Coordination Group / Technology Deployment Center
U.S. Department of Energy, Idaho Operations Office**

Idaho National Engineering and Environmental Laboratory



INEEL Light Duty Utility Arm System

Problem: Consent agreements with the State of Idaho require entry into highly radioactive tanks in order to assess structural integrity and obtain samples of tank residue to support development of tank closure plans.

Baseline Technology: Previous “tool-on-a-stick” approaches limit direct assessment to surfaces and residues immediately below a limited number of tank access risers.

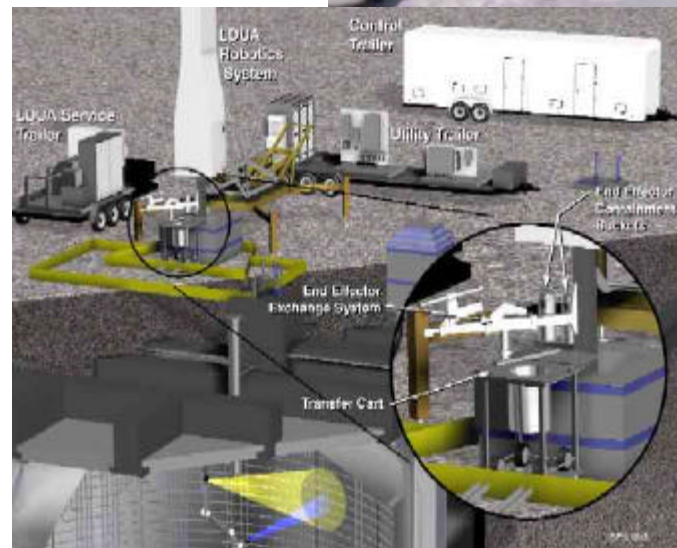
Innovative Technology: The LDUA Robotic System allows remote assessment of in-tank structures and sampling of residue within a 10 foot radius of the tank riser axis.

Comparison: The baseline approach has not satisfied regulator's demands for off-riser assessment of structural integrity and residue composition, and places workers at risk for exposure to radioactive and hazardous materials.

Benefits: Tank characterization data acquired using the LDUA System and associated end effectors could reduce the cost of closing INEEL's eleven high level waste tanks by several hundred million dollars.

TMS#: 85

INEEL Light Duty Utility Arm System



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LDUA - Heel Sampling End Effector

Problem: Consent agreements with the State of Idaho require entry into highly radioactive waste tanks in order to obtain samples of tank residue to support development of tank closure plans.

Baseline Technology: Radiation exposure associated with sampling of tank residue precludes retrieval by a human operator.

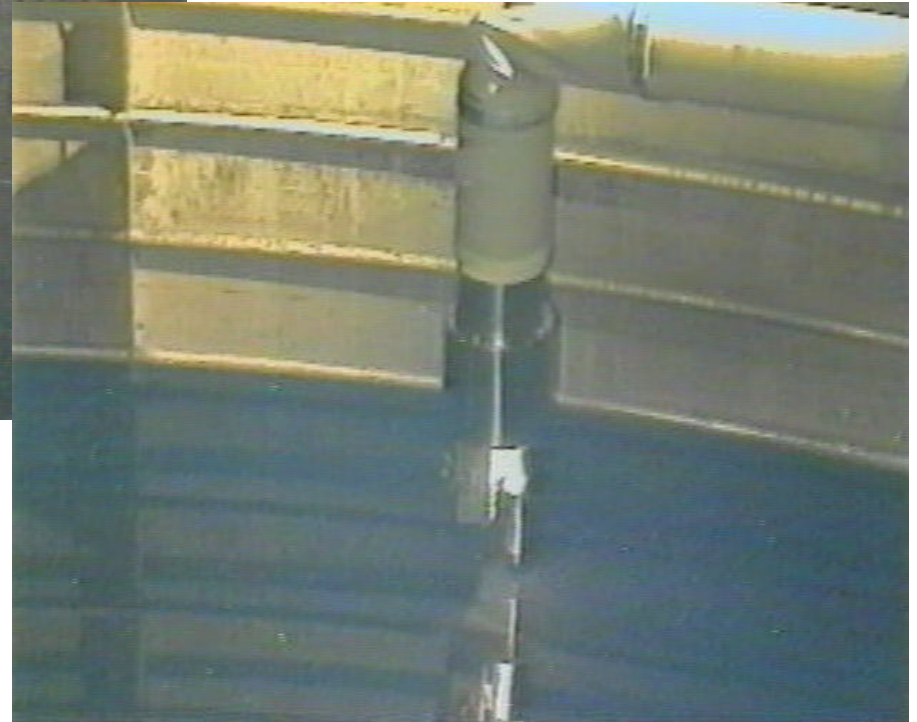
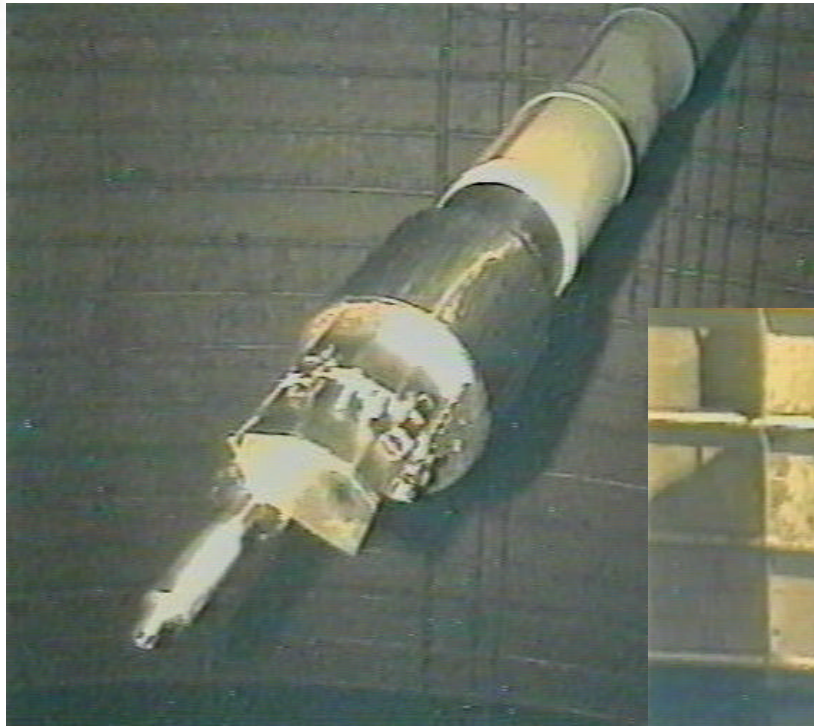
Innovative Technology: The Heel Sampling End Effector allows remote recovery of up to 800 ml of liquid or slurry using the LDUA Robotic System. Detachable sample chambers allow collection of multiple samples during a single campaign.

Comparison: The Heel Sampling End Effector enables sampling of highly radioactive waste tank heels where no other approach is feasible.

Benefits: Tank characterization data acquired using the Heel Sampling End Effector could reduce the cost of closing INEEL's eleven high level waste tanks by several hundred million dollars.

TMS#: 2386

LDUA - Heel Sampling End Effector



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LDUA - OSS Tank Inspection End Effector

Problem: Consent agreements with the State of Idaho require entry into highly radioactive waste tanks in order to assess their structural integrity.

Baseline Technology: Radiation exposure associated with tank residues precludes direct tank examination by a human operator.

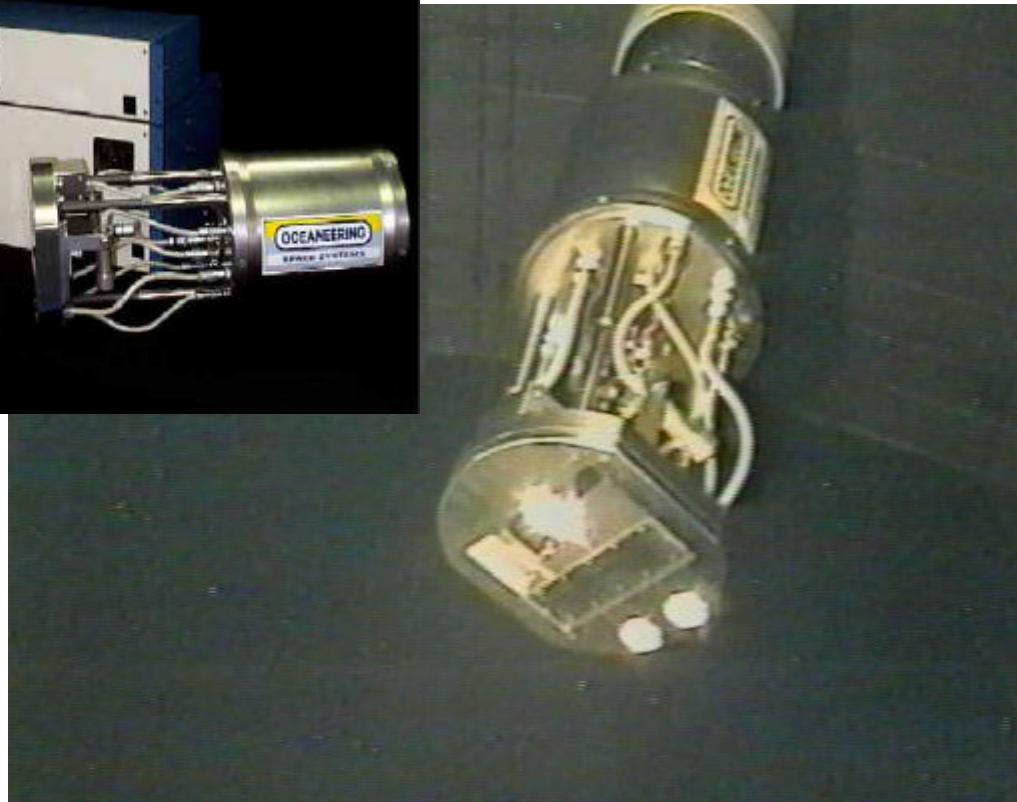
Innovative Technology: Oceaneering Space System's Tank Inspection End Effector allows remote non destructive examination of steel waste tanks using the LDUA Robotic System.

Comparison: The OSS Tank Inspection End Effector enables rapid survey of weld integrity and potential corrosion damage in highly radioactive waste tanks where no other approach is feasible.

Benefits: While the OSS Tank Inspection End Effector was successfully deployed in INTEC tank WM-188, it is not thought valuable for INEEL tank closure efforts, as system resolution is too low to detect visible surface imperfections.

TMS#: 278

LDUA - OSS Tank Inspection End Effector



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LDUA - High Resolution Stereo Video End Effector

Problem: Consent agreements with the State of Idaho require visual inspection of highly radioactive waste tanks in order to support development of tank closure plans.

Baseline Technology: Radiation exposure associated with tank residues precludes visual examination of tank internals using a pole-mounted video camera that is guided by a human operator.

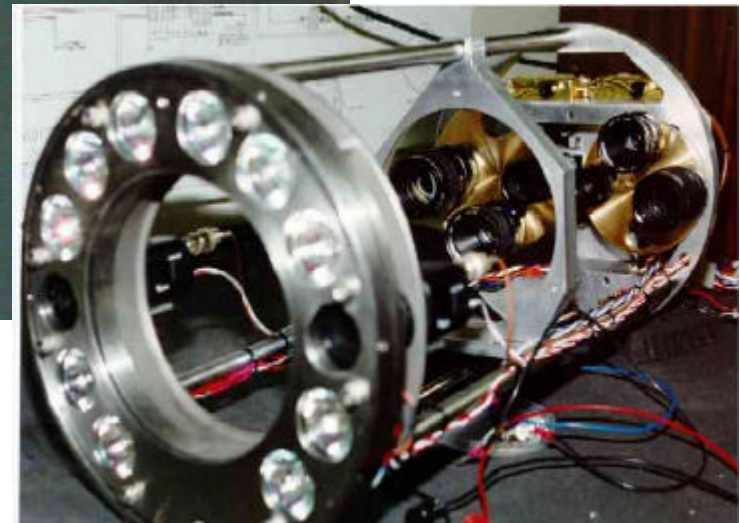
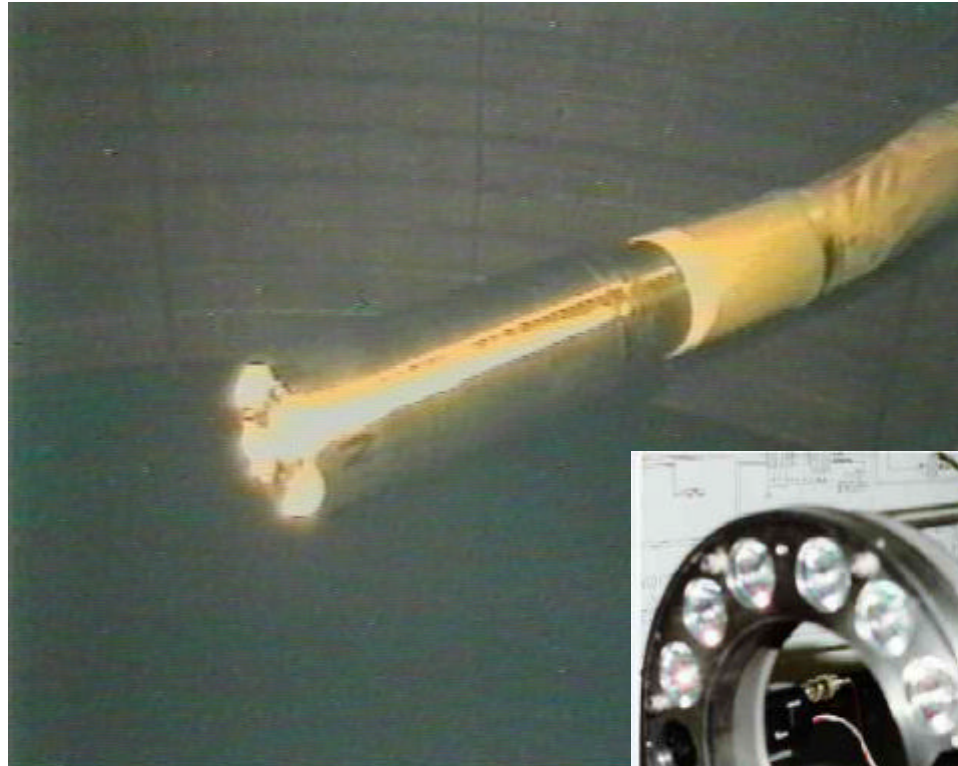
Innovative Technology: The High Resolution Stereo Video End Effector is a fixed-focus stereo viewing system engineered for remote deployment using the LDUA Robotic System.

Comparison: The High Resolution Stereo Video End Effector enables visual inspection and sizing of in-tank features where no other approach is feasible.

Benefits: Tank characterization data acquired using the High Resolution Stereo Video End Effector could reduce the cost of INEEL tank closure efforts by a least five million dollars through avoidance of costs associated with building of new storage tanks.

TMS#: 890

LDUA - High Resolution Stereo Video End Effector



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LDUA - Remote End Effector Exchange Plate

Problem: Consent agreements with the State of Idaho require multiple entries into highly radioactive waste tanks in order to assess structural integrity and obtain samples of tank residue to support development of tank closure plans.

Baseline Technology: Utilities for LDUA end effectors must be manually coupled during end effector exchange.

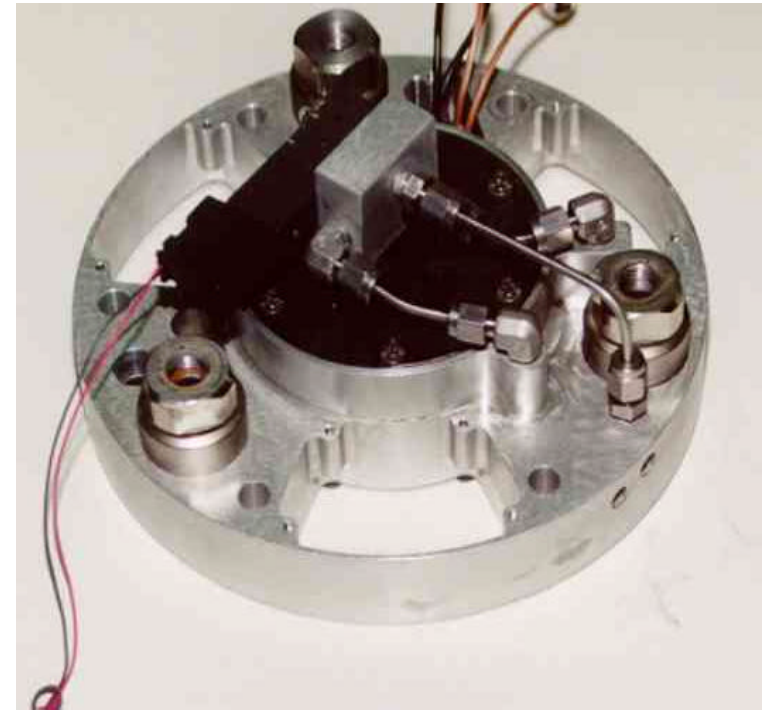
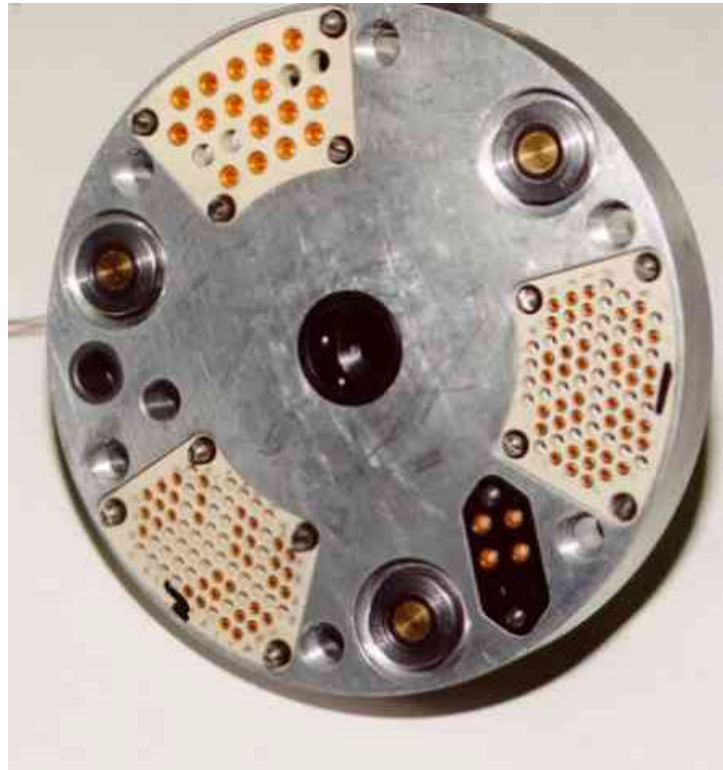
Innovative Technology: Master and slave Remote End Effector Exchange Plates provide a sealed pass-through for electrical and pneumatic utilities configured for multiple LDUA end effectors.

Comparison: The End Effector Exchange Plate enables deployment of multiple end effectors during a single LDUA campaign, since extensive decontamination and direct worker contact is not required for end effector exchange.

Benefits: The End Effector Exchange Plate enabled nine end effector or sample chamber exchanges during its initial deployment and is estimated to have saved 675 man-hours of labor cost and reduced radiation exposure by approximately 250 mrem.

TMS#: 2394

LDUA - Remote End Effector Exchange Plate



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LDUA - Remote End Effector Exchange System

Problem: Consent agreements with the State of Idaho require multiple entries into highly radioactive waste tanks in order to assess structural integrity and obtain samples of tank residue to support development of tank closure plans.

Baseline Technology: Previous deployments of LDUA have required manual exchange of end effectors and arm/riser realignment for each tank entry.

Innovative Technology: The Remote End Effector Exchange System positions and couples end effectors without altering the LDUA's alignment with the tank riser.

Comparison: The Remote End Effector Exchange System enables deployment of multiple end effectors during a single tank characterization campaign.

Benefits: The End Effector Exchange System enabled nine end effector or sample chamber exchanges during its initial deployment and is estimated to have saved 675 man-hours of labor cost and reduced radiation exposure by approximately 250 mrem.

TMS#: 2393

LDUA - Remote End Effector Exchange System



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